

From LEO to the Planets Using Waveriders

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A revolutionary interplanetary transportation technique known as Aero-Gravity Assist (AGA) has been studied by JPL and others to enable relatively short trip times between Earth and the other planets. It takes advantage of an advanced hypersonic vehicle known as a waverider that uses its high lift to fly through the atmospheres of Venus and Mars to provide exceptionally large gravity-assist maneuvers. The concept has been under study in a joint program between JPL and the University of Maryland for almost a decade. More recently Purdue University has become a partner. The waverider concept has been proposed as an upper stage vehicle compatible with the Lockheed Martin Venture Star SSTO vehicle. This integrated vehicle concept could be used to launch spacecraft on interplanetary missions. A waverider stage concept that has been sized to be compatible with the Venture Star payload bay will be presented.

The paper will discuss the mission possibilities enabled by this integrated vehicle as well as a program necessary to develop the waverider as an AGA vehicle. Flight durations to various destinations in the solar system can be reduced by large factors (e.g., 2-5 times shorter duration). The paper will present results of recent studies of interplanetary and atmospheric trajectories to many bodies, with navigation errors and make-up, of velocity loss at each AGA maneuver. Vehicle design includes possible ablation of heat shield material, and possible location and nature of control surfaces, along with engines and propellant to escape from Earth. Other advantages of this technique over normal interplanetary delivery methods will be discussed.